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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/578,550	07/06/2007	Brian Ruby	5688/004	9472

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EXAMINER
MILLER, JR, JOSEPH ALBERT

ART UNIT	PAPER NUMBER
1792	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/578,550	RUBY, BRIAN	
	Examiner	Art Unit	
	JOSEPH MILLER JR	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 March 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *74-93* is/are pending in the application.

4a) Of the above claim(s) *88-93* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *74-87* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of claims 74-87 in the reply filed on 03/30/2009 is acknowledged.

Specification

The amendment filed 05/06/2006 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

a. paragraphs [0024-0025] and related figures 5A, 5B, 6A, and 6B were not included in the PCT filing;

b. new text has been added in [0036], apparently starting from "6,346,189" through "argon gas flow"; and

c. paragraphs [0038-0040] constitute new matter.

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 82 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The range 0.5 to 50 volts is not contained in the specification.

Furthermore, instant range was not included in the claims included in the original PCT document.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 74, 75, 79 and 80 are rejected under 35 U.S.C. 102(b) as anticipated by Dai (6,401,526).

Dai teaches the formation of a substrate with multiple tips (support structures) for the growth of nanotubes (Fig. 2A) and the catalyst coating of the tips (Fig. 2B) (col 6, lines 10-33), thereby teaching the coating step of instant claim; it is clear that the tips having a base and apex. Nanotubes are then grown on the tips (Fig. 2D).

Dai further teaches the shortening of the nanotubes to a predetermined length (col 7, lines 22-53), performed by positioning a second substrate against the nanotube tips. The second substrate is positioned distal to the multiple tips; because the substrate is positioned at the tips, the distance correlates with the maximum predetermined length of the nanotubes.

The nanotubes are "formed", i.e. shortened by applying a voltage between the second substrate and the base substrate of the SWNTs. Based on Fig. 2D, the original tips are still present at the shortening (i.e. forming) phase.

Regarding claim 75, Dai teaches the formation of carbon nanotubes.

Regarding claim 79, the second substrate is a heavily doped (i.e. conductive) silicon substrate (col 7, lines 44-48).

Regarding claim 80, Dai teaches the use of voltage to shorten carbon nanotips.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 76 and 77 are rejected under 35 U.S.C. 103(a) as unpatentable over Dai (6,401,526) as applied to claim 74 above.

The teachings of Dai are described above.

Dai teaches the disposition of the catalyst material on the tips whereon nanotubes will be formed (col 6, lines 10-33). Dai specifically teaches an embodiment where the tips are attached to a “towered” so that the catalyst coating will be on the ‘sides’ of the tips (col 6, lines 34-44). The 'sides' as indicated by Dai are not limited and it would be obvious to coat the apex and/or the base of the tips, either in the embodiment depicted in Figs 2 or Fig. 3.

While the depiction in Figures 2A-D *appears* to show coating of the catalyst between the apex and the base, Dai is not limited to the embodiment depicted in the Figures. The third embodiment is intended in fact only to avoid catalyst material from depositing on the substrate between the support structures.

Claims 74-77, 80, 85 and 86 are rejected under 35 U.S.C. 103(a) as unpatentable over Lee (2002/0046953) in view of Dai (6,401,526).

Lee teaches a method of catalyst induced nanotube growth (abstract). Lee teaches the formation of a substrate 57 (**or** 53) (Fig. 6, [0055], [0063]) including a plurality of nanotube growth catalysts placed opposite to a second substrate (55, Fig. 6). The carbon nanotubes are then grown by flowing a carbonaceous gas in the chamber area (i.e. between the two substrates). Though not specifically stated, the growth of the nanotubes would clearly be limited by the distance between the substrates 53/57 and 55. Lee teaches the control of the length of the nanotubes via control of the CVD process duration [0070]. It would have been obvious to someone of ordinary skill in the art at the time of the invention to limit the duration accordingly with the distance

between the substrates as this would minimize chamber space, potentially reducing the amount of gas (and energy) needed to effect growth of the nanotubes. One would not desire the chamber to be larger than the maximum size of nanotips to be produced.

While Lee teaches the use of a substrate with multiple tips for the formation of carbon nanotubes, he teaches deposition of catalyst material on individual tips and does not explicitly teach the formation of a catalyst layer on a substrate with multiple tips.

Dai teaches the formation of a substrate with multiple tips (support structures) for the growth of nanotubes (Fig. 2A) and the catalyst coating of the tips (Fig. 2B) (col 6, lines 10-33), thereby teaching the coating step of instant claim; it is clear that the tips having a base and apex. Nanotubes are then grown on the tips (Fig. 2D).

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the method of coating multiple tips for nanotube growth via the method of Dai to the nanotube formation process of Lee because it would allow one not only to grow multiple nanotubes at one time but form the 'precursor' tips at one time, thereby saving process time. It is clear that "mass production" is important to Lee both in statement [0052] and the growth of multiple nanotubes simultaneously. Each teaches the formation of tips for AFMs (abstracts), therefore one would expect the quality of the formed nanotubes to be comparable/applicable.

Regarding claim 75, Lee teaches carbon nanotubes (abstract).

Regarding claims 76 and 77, Dai teaches the disposition of the catalyst material on the tips whereon nanotubes will be formed (col 6, lines 10-33). Dai specifically teaches an embodiment where the tips are attached to a “towered” so that the catalyst

coating will be on the ‘sides’ of the tips (col 6, lines 34-44). The 'sides' as indicated by Dai are not limited and it would be obvious to coat the apex and/or the base of the tips, either in the embodiment depicted in Figs 2 or Fig. 3.

Regarding claim 79, it would be obvious to apply the use of a conductive second substrate, as Lee teaches it as an “anode”.

Regarding claim 80, Dai teaches the shortening of the nanotubes to a predetermined length (col 7, lines 22-53), performed by positioning a second substrate against the nanotube tips by applying a voltage across the two substrates. It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the method taught by Dai to shorten nanotubes formed by the method of Lee in view of Dai as one could effectively shorten the nanotubes to desired length based on Dai’s success in shortening nanotubes.

Regarding claim 85, Lee teaches the use of a vacuum chamber [0064] at a temperature of 700 degree or 900-1000 degrees Celsius in some embodiments [0067-8] using gases such as methane, nitrogen and hydrogen [0071].

Regarding claim 86, Lee is silent on the time of flowing of gases, however, it would be a matter of standard process optimization to determine the amount of time required to form nanotubes of the desired length, based on the total process conditions used, including but not limited to gas flows, pressure, and temperature.

Claims 78, 81, 82 and 87 are rejected under 35 U.S.C. 103(a) as unpatentable over Lee (2002/0046953) in view of Dai (6,401,526) as applied to claims 74 and 85, respectively above and in further view of Lieber (2002/0122766).

The teachings of Lee in view of Dai are described above. Lee teaches formation of carbon nanotubes via a CVD process but does not specifically teach flushing the area with a nonreactive gas or cleaving a nanotube from a substrate using voltage.

Lieber teaches the formation of carbon nanotubes via CVD (abstract).

Regarding claims 78 and 87, Lieber teaches the use of argon gas during the furnace heat up and cool down periods (examples 5 and 7, [0099, 0103]). It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the use of an inert and/or nonreactive gas into the chamber during heat up and cool down periods as flowing such a gas into the chamber would allow the chamber to come to the appropriate temperature with a gas present but allow for a controlled reaction by avoiding the presence of a reactive gases (i.e. if the reactive gases were applied during cool down, nanotube formation may continue, but in a less controlled manner than during a stable temperature process). The introduced gases are obviously and/or inherently flushed through the chamber.

Regarding claims 81 and 82, Lieber teaches that applying voltage between two substrates may be used to cleave the nanotube/tip from the substrate [0079]. It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the use of the voltage to cleave a nanotube from a substrate as taught by Lieber to the method of Dai as one could apply an appropriate voltage as taught by Lieber to

the method of Dai and have a reasonable expectation of cleaving a nanotube based on Lieber's success in doing so. Lieber teaches the use of voltage in the range of 10-25V thereby reading on instant claimed range.

Claims 82 and 83 are rejected under 35 U.S.C. 103(a) as unpatentable over Lee (2002/0046953) in view of Dai (6,401,526) as applied to claim 74 above and in further view of Mancevski (6,597,090).

The teachings of Lee in view of Dai are described above. Lee teaches formation of carbon nanotubes via a CVD process but does not specifically teach cleaving and shortening the nanotubes using liquid or gas phase chemicals.

Mancevski teaches a process for forming carbon nanotubes via CVD (col 10, lines 1-40). Mancevski teaches that wet or dry etching may be used to uncover carbon nanotubes from a matrix/substrate material (col 10, lines 41-46). The etching is used to control the length of the nanotube as well as to remove it from the substrate (col 11, lines 6-21).

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the use of wet or dry etching (liquid phase, claim 83 or gas phase, claim 84) as taught by Mancevski to the carbon nanotube formation method of Lee as one could apply wet or dry etching with a reasonable expectation of removing carbon nanotubes from a substrate based on Mancevski's successful use of the methods. In each teaching the resulting nanotubes may be used as AFM tips (Mancevski, col 11, lines 18-21) based on similarities in substrates.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOSEPH MILLER JR whose telephone number is (571) 270-5825. The examiner can normally be reached Mon - Fri, 7am to 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/JOSEPH MILLER JR/
Examiner, Art Unit 1792

/Timothy H Meeks/

Supervisory Patent Examiner, Art Unit 1792